

BLM Manual Handbook 9177-3

REPORTING

Dam Failures

(PUBLIC)



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I. Introduction

The Reporting Dam Failures Handbook establishes guidelines for appointing boards of inquiry to investigate failures of dams on lands administered by the Bureau of Land Management (BLM) and the format for reporting those failures. The plan of operations followed by the board of inquiry should be based on the board's full consideration of the given problem. To ensure that all essential elements of information are collected and reported in a usable form, general instructions for the conduct of inquiries are presented in this Handbook. Plans of operations for boards of inquiry should conform to these instructions to the greatest practicable extent. The completed report must be submitted to the State Office, Chief, Branch of Engineering and Support Services, and a copy sent to the Dam Safety Officer within 60 days after the failure.

II. Composition of Board.

The board of inquiry must be composed of, at a minimum, the State Office Dam Safety Coordinator (Chairperson); Field Office or District Office Chief of Operations or Administrative Officer; District or Zone Engineer; and one or more resource or technical specialists (as appointed by the District or Field Manager). The State Director, Field Office Manager, or District Office Manager may request assistance from other agencies on an as-needed basis.

III. Procedures for Investigating Failures.

- A. *Inspect the Site.* Note all visible signs of the failure, evidence of watermarks, and all site conditions that may be pertinent to evaluating the failure. Include photographs in the report, as appropriate. If borings, test pits, sampling, or onsite tests are needed, contact the State Office, Chief, Branch of Engineering and Support Services, immediately to arrange for such operations.
- B. *Study all Pertinent Records and Documents.* This study should include:
 - 1. Reports of previous inspections by other Bureau personnel.
 - 2. Statements of eyewitnesses.
 - 3. Construction records including diaries, reports, and test records.
 - 4. The design file, with special regard for design investigation and survey reports, design assumptions, design criteria, and design details.
 - 5. Construction specifications and contract modifications.
- C. *Interview Key Personnel and Witnesses.* Preferably at the structure site, interview such Bureau personnel and eyewitnesses as may be desirable to clarify or supplement pertinent information contained in reports and documents.

IV. Report Format.

The following information must be incorporated into the report (Figure).

- A. *Summarize the Facts.* List the facts that are supported by evidence observed on the site, documented in investigation reports, noted in the design file, recorded in construction records, or stated by eyewitnesses. The list should include all pertinent facts, including:
1. A description of the failure, its signs and results and, if possible, a statement of the sequence and timing of events before and during the failure.
 2. A summary of the site conditions and the character of the materials, as determined by the design investigations.
 3. A description of the nature of the design with particular emphasis on the critical features that may be pertinent to the failure and a list of the acknowledged (or clearly inferred) risks taken.
 4. A summary of conditions encountered during construction, exposed by the failure, or disclosed by subsequent investigations, that differed from those assumed as a basis for design.
 5. A summary of the background of experience in the use of similar designs under similar conditions.
 6. A summary of the critical provisions of the construction specifications.
 7. A summary of items in the construction records that may: (a) be pertinent to the time sequence of the failure, (b) indicate the scope and quality of the inspection, or (c) indicate whether or not the construction complied with the critical provisions of the specifications.
 8. A summary of the actions taken after the failure.
- B. *Summarize the Possible Causes of Failure.* List all of the possible causes of failure that are consistent with the observed failure symptoms and known facts.
- C. *Evaluate Data to Determine Probable Cause.* Evaluate each possible cause of failure in light of the known facts to determine which is the most probable. Such evaluation usually must be made by a deductive process involving:
1. A careful study of the facts.
 2. A consideration of which facts are consistent with the mechanics of the assumed conditions.
 3. A consideration of which assumptions seem most plausible in light of the sequence and timing of events.
- D. *Evaluate the Collection and Interpretation of Basic Data.* Study the design file to determine whether or not sufficient basic data were collected by surface reconnaissance, surveys, subsurface investigations, materials testing, hydrologic studies, and other special studies to furnish an adequate basis for design. In the course of this evaluation, the board must judge whether:

1. The quantity of data collected is sufficient (consistent with the class of project) to represent all pertinent site conditions and hydrologic conditions.
2. The quality of the data collected is sufficient to allow reasonable confidence in the assumptions and approximations that were made in establishing design criteria.

If the quantity or quality of the basic data is not considered adequate, the board should determine whether:

1. The omissions, discrepancies, or inadequacies were noted and reported by the designer to the authorities responsible for the collection of data.
2. If such reports were made, adequate and timely measures were taken to collect the necessary supplementary data.

Having evaluated the character of the basic data, the board should judge whether design assumptions, deductions, and approximations represent a reasonable interpretation of the basic data in light of the facts known at the time the design was accomplished. Furthermore, if the record indicates that conditions encountered during construction were appreciably different from those assumed in design, the board should determine whether:

1. The changed conditions were adequately reported to the designer.
2. Appropriate action was taken to verify the adequacy of the design or to modify it to compensate for the effects of the actual site conditions.

E. Evaluate the Design. List and evaluate the features of the design that aggravated or alleviated the apparent failure conditions. This evaluation must consider the features that are normally required by professionally accepted design criteria to protect the structure from the effects of potentially dangerous conditions inherent in the site and materials. The effect of incorporating or omitting specific design features must be carefully considered. Whenever the design file indicates that critical features were intentionally omitted or substantially modified as the result of assuming design risks, this fact must be analyzed in the light of prescribed criteria, Bureau experience, the conditions unique to the site, and professional acceptance of such risks. The board should thoroughly examine the justification for the assumption of design risk. By reviewing the pertinent files and interviewing knowledgeable personnel, the board should determine whether the assumption of risk was based on:

1. Engineering interpretation of valid basic data.
2. Arbitrary adjustment of criteria to limitations or commitments imposed in the planning phase.
3. Arbitrary adjustment of criteria to limitations imposed by administrative decision in the operations phase. Copies of all data and correspondence bearing on the justification for the assumption of design risk should be collected and attached to the report.

- F. *Evaluate the Construction Operation.* List and evaluate the elements of the construction operation that might have a critical bearing on the type of failure considered most probable. The evaluation must consider the facts from three different standpoints:
1. Whether the construction operation complied with the critical provisions of the contract specifications.
 2. Whether the contract specifications were adequate as applied to the project under consideration.
 3. Whether the inspection program was adequate.
- G. *Prepare Conclusions.* From the evaluation of the facts, prepare the conclusions that seem to be most reasonable with regard to:
1. Whether the proximate cause of failure can be determined (if so, it must be stated).
 2. Whether responsibility can be assigned to: (a) planning deficiencies, (b) investigational deficiencies, (c) design deficiencies, (d) construction deficiencies, (e) any combination of procedural deficiencies, (f) natural occurrences beyond the reasonable control of the interested parties, or (g) administrative deficiencies.
 3. If a combination of deficiencies is suspected, but no tangible proof exists, that the failure could have occurred even if the construction complied with the provisions of the specifications.
 4. Whether Bureau criteria, procedures, and actions were adequate.
- H. *Prepare Recommendations.* Recommend actions to be taken to:
1. Repair, replace, or abandon the structure.
 2. Improve planning, investigation, or design criteria or to ensure the use of existing criteria.
 3. Improve construction specifications or to ensure the use of existing specifications.
 4. Improve methods, procedures, and policies for planning, design, inspection, and construction management.

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